

## A Chromosome Study on Seven Wild *Allium* Species in the Tianshan Mountains, Xinjiang, China

Hisakazu OGURA<sup>a</sup>, Katsuhiko KONDO<sup>b</sup>, Dun-yan TAN<sup>c</sup>, Jian-feng MAO<sup>c</sup>,  
Tsuneo FUNAMOTO<sup>d</sup>, Shiguang GUO<sup>a</sup>, Daming ZHANG<sup>c</sup> and De-yuan HONG<sup>c</sup>

<sup>a</sup>Laboratory of Biology, Faculty of Education, Okayama University,  
Tsushima-naka, Okayama, 700-8530 JAPAN;

<sup>b</sup>Laboratory of Chromosome and Gene Stock, Graduate School of Science,  
Hiroshima University, Kagamiyama, Higashi-Hiroshima, 739-8526 JAPAN;

<sup>c</sup>Laboratory of Systematic and Evolutionary Botany, Institute of Botany,  
Chinese Academy of Sciences, Beijing, 100093 CHINA;

<sup>d</sup>Biological Institute, Showa Pharmaceutical University, Higashi-Tamagawa  
Gakuen, Machida, Tokyo, 194-8543 JAPAN

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Seven *Allium* species collected in the Tianshan Mountains, Xinjiang, China were karyologically studied. They commonly showed the chromosome number of  $2n = 16$ . The chromosome complement of 14m and two sm chromosomes was found in *A. deserticolum* and *A. oreoprasum*; 14m and two st chromosomes were found in *A. globosum* and *A. platyspathum*; 12m, 2sm, 2st chromosomes were found in *A. caricoides*; 12m and 4st chromosomes were found in *A. korolkowi*; 16m chromosomes were found in *A. obliquum*. Chromosome numbers and the karyotypes of *A. caricoides* and *A. deserticolum* are reported here for the first time.

**Key words:** *Allium* species, karyotype, Tianshan Mountains, Xinjiang.

The genus *Allium* is mainly distributed in the temperate regions of the Northern Hemisphere and consists of ca. 660 species (Xu and Kamelin 2000). Xu and Kamelin (2000) reported that 138 species were recognized in China, among which 50 species were endemic. Cytological studies have revealed the chromosome number and karyotype of some Chinese *Allium* species (Tolgor et al. 1994, Wang et al. 1994, Xu et al. 1994, Ogura et al. 1999, 2002, Zhu and Xu 1999). However, karyotypes of many of them are not well documented in most standard references. This paper reports somatic chromosome numbers and karyotypes at metaphase stage in seven species of *Allium* collected during fieldwork in the Tianshan Mountains in Xinjiang, China in 2002.

### Materials and Methods

We made a journey along the central region of Tianshan Mountains from Urumqi City to Yining City in September, 2002 and collected wild *Allium* species (Fig. 1 and Table 1). They were cultivated in pots in the Laboratory of Biology, Faculty of Education, Okayama University. Root-tips were collected and pretreated by 0.002 M 8-hydroxyquinoline solution for 3 h at 20°C and fixed with acetic alcohol (1 : 3). Then, they were stained and squashed with 1 % aceto-orcein solution and the squashed preparations were used for microscopic observation. Chromosomes at mitotic metaphase were classified by arm ratio (AR) followed by Levan et al. (1964); Median-centromeric ( $1.0 \leq \text{AR} < 1.7$ ), submedian-

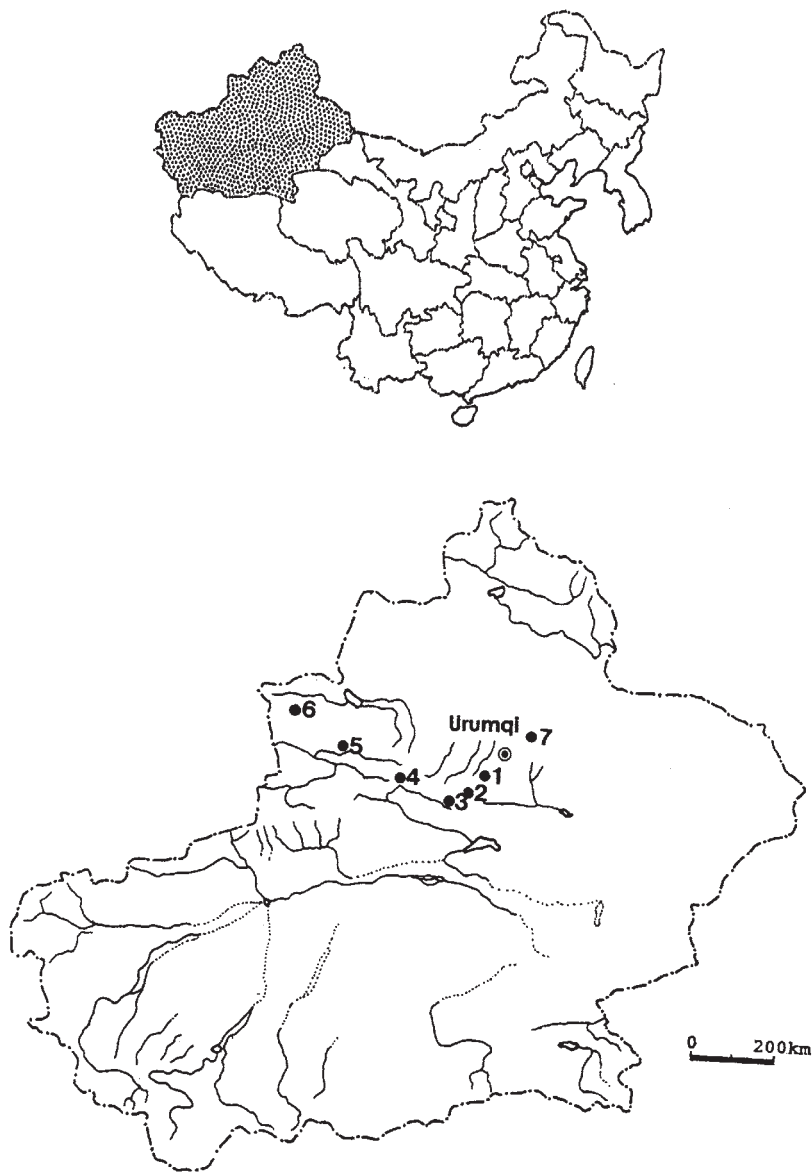


Fig. 1. Maps of study sites of seven *Allium* species in Xinjiang, China. Species names collected are shown in parentheses: 1. Houxia, Urumqi County (*A. platyspathum*). 2. Balantai, Hejin County (*A. korolkowi*). 3. Bainbluke Grassland, Hejin County (*A. caricoides*). 4. Nalati Grassland, Xinyuan County (*A. obliquum*). 5. Gongniu County (*A. deserticolum*). 6. Sai La Mu Lake, Bole City (*A. globosum*). 7. Tianchi Lake, Fukan County (*A. oreoprasum*).

Table 1. Collection site, sample number, and chromosome numbers of seven *Allium* species collected in the Tianshan Mountain area, Xinjiang, China

Species	Collection site	Sample number	Chromosome number
<i>A. caricoides</i> Regel	Bainbluke Grassland, Hejin County, alt. 2,600 m	20	16
<i>A. deserticolum</i> M. Pop.	Gongniu County, alt. 1,500 m	11	16 (+2s)
<i>A. globosum</i> M. Bieb. ex Redoute	Sai La Mu Lake Bole City, alt. 2,120 m	6	16
<i>A. korolkowi</i> Regel	Balantai, Hejin County, alt. 2,720 m	20	16
<i>A. obliquum</i> L.	Nalati Grassland, Xinyuan County, alt. 2,600 m	5	16
<i>A. oreoprasum</i> Schrenk	Tianchi Lake, Fukan County, alt. 1,850 m	20	16
<i>A. platyspathum</i> Schrenk	Houxia, Urumqi County, alt. 1,900 m	4	16

centromeric ( $1.8 \leq AR < 3.0$ ), subterminal-centromeric ( $3.1 \leq AR < 7.0$ ) and terminal-centromeric ( $7.1 \leq AR$ ) chromosomes were abbreviated and symbolized as m, sm, st, and t, respectively. Chromosome length was measured and calculated on the basis of a typical and well-spread metaphase cell. The voucher specimens of these *Allium* plants were deposited in the Laboratory of Biology, Faculty of Education, Okayama University.

### Results and Discussion

Chromosome numbers of the seven *Allium* species was found to be commonly  $2n = 16$  (Figs. 2, 3 and Table 1). The karyotypes are shown in Fig. 3. Among these species, some of *A. deserticolum* samples had two supernumerary chromosomes (Figs. 2, 3). The karyotype formula of these species was as follows: *A. caricoides*,  $2n = 16 = 14m + 2sm + 2st$ ; *A. deserticolum*,  $2n = 16 + 2s = 14m + 2sm + 2s$ ; *A. globosum*,  $2n = 16 = 14m + 2st$ ; *A. korolkowi*,  $2n = 16 = 12m + 4st$ ; *A. obliquum*,  $2n = 16 = 16m$ ; *A. oreoprasum*,  $2n = 16 = 14m + 2sm$ ; *A. platyspathum*,  $2n = 16 = 14m + 2st$ . All these seven species were considered to be diploid with the basic chromosome number  $x = 8$ . The mitotic metaphase chromosomes in the seven species studied had the common characters such as gradual decrease in the chromosome length from the largest to the shortest chromosomes, or monomorphic karyotype. Mean chromosome length of *A.*

*obliquum* was largest, while that of *A. oreoprasum* was the smallest. The smallest chromosome of *A. obliquum* was larger than the largest chromosome of *A. oreoprasum* and *A. korolkowi* (Table 2). Chromosome number described by previous studies are also shown in Table 2: only the plants with  $2n = 16$  have been found in *A. korolkowi*, *A. oreoprasum* and *A. platyspathum*, whereas the plants with  $2n = 16$  and those with  $2n = 32$  have been reported in *A. globosum* and *A. obliquum*. Among these species, *A. caricoides*, *A. deserticolum* and *A. korolkowi* are endemic to the Tianshan Mountains (Xu and Kamelin 2000). The chromosome numbers and the karyotypes of *A. caricoides* and *A. deserticolum* are reported here for the first time.

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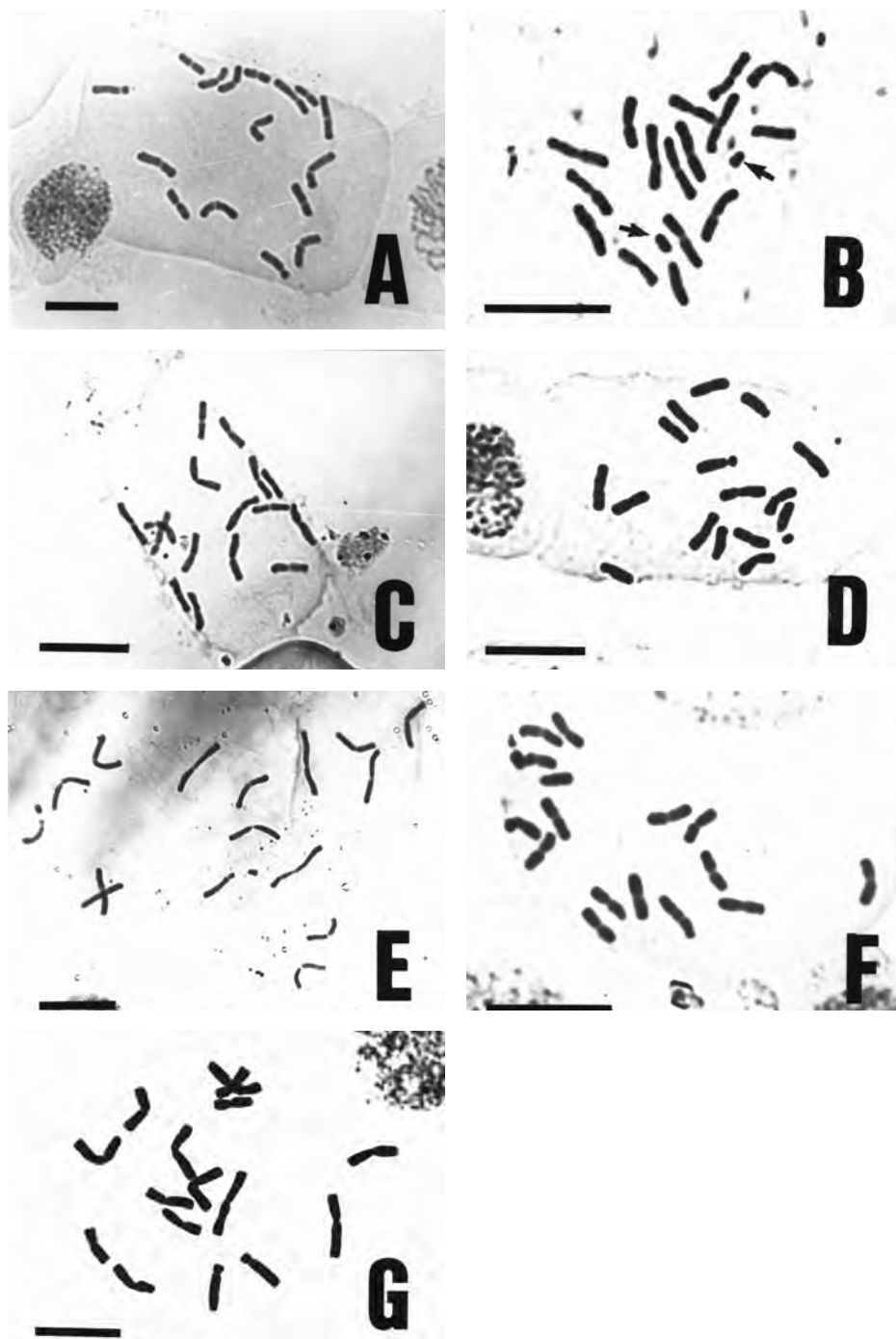


Fig. 2. Somatic chromosomes at metaphase stage of seven *Allium* species. Arrows in B indicate supernumerary chromosomes. Bar = 10  $\mu$ m. A. *A. caricoides*. B. *A. deserticolum*. C. *A. globosum*. D. *A. korolkowi*. E. *A. obliquum*. F. *A. oreoprasum*. G. *A. platyspathum*.

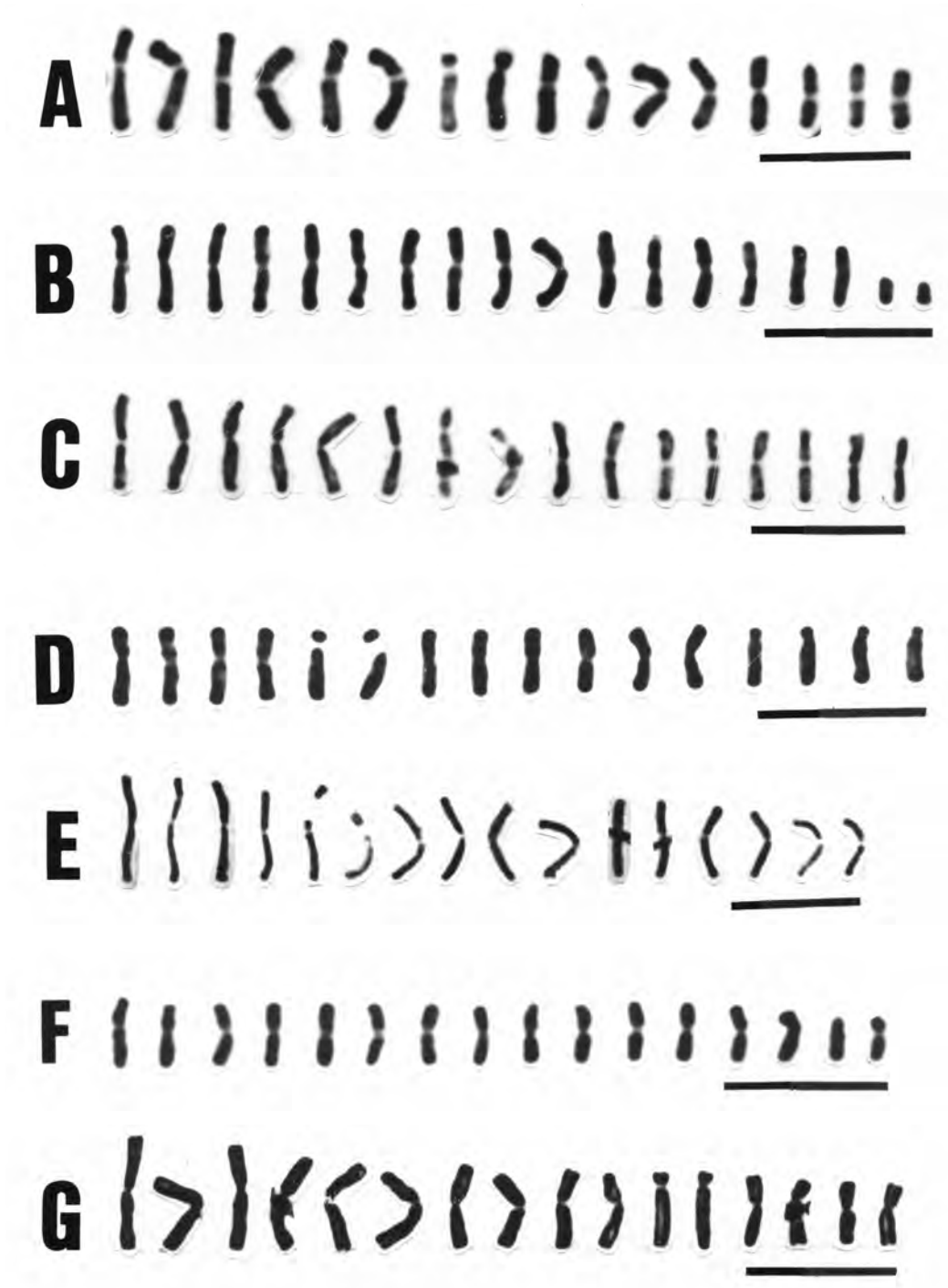


Fig. 3. Karyotypes of seven *Allium* species. Bar = 10  $\mu$ m. A. *A. caricoides*,  $2n = 16 = 12m + 2sm + 2st$ . B. *A. deserticum*,  $2n = 16 = 14m + 2sm + (2s)$ . C. *A. globosum*,  $2n = 16 = 14m + 2st$ . D. *A. korolkowi*,  $2n = 16 = 12m + 4st$ . E. *A. obliquum*,  $2n = 16 = 16m$ . F. *A. oreoprasum*,  $2n = 16 = 14m + 2sm$ . G. *A. platyspathum*,  $2n = 16 = 14m + 2st$ .

Table 2. Comparison of the chromosome number, length and shape of the seven *Allium* species, as well as previous chromosome count

Species	Chromosome number (2n)	Chromosome length (μm)				Form			Chromosome number in the previous studies
		Largest	Smallest	Total	Mean	m	sm	st	
<i>A. caricoides</i> Regel	16	6.6	3.7	84.8	5.3	12	2	2	—
<i>A. deserticolum</i> M. Pop	16	5.1	3.4	72.3	4.5	14	2	—	—
<i>A. globosum</i> M. Bieb. ex Redoute	16	6.3	4.3	85	5.3	14		2	2n = 16 (Magulaev 1976) 2n = 32 (Nanuscyan and Polyakov 1989)
<i>A. korolkowi</i> Regel	16	4.7	3.3	63.9	4	12		4	2n = 16 (Vakhtina and Kudrjaschova 1981)
<i>A. obliquum</i> L.	16	8.4	4.9	106	6.6	16			2n = 16 (Vosa 1977) 2n = 32 (Jacobsen and Ownbey 1977)
<i>A. oreoprasum</i> Schrenk	16	4.1	2.5	53.7	3.4	14	2		2n = 16 (Vakhtina and Kudrjaschova 1977)
<i>A. platyspathum</i> Schrenk	16	8.1	4.5	96.3	6	14		2	2n = 16 (Zakirova and Nafanailova 1988)

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小倉久和<sup>a</sup>, 近藤勝彦<sup>b</sup>, 譚 敦炎<sup>c</sup>, 毛 建丰<sup>c</sup>,  
船本常男<sup>d</sup>, 郭 始光<sup>a</sup>, 張 大明<sup>c</sup>, 洪 徳元<sup>c</sup>:  
中国新疆・天山山脈産ネギ属 7 種の染色体研究

2002 年 9 月に中国新疆・天山山脈で野生ネギ  
属 *Allium* の調査を実施し, この調査で採集された  
ネギ属 7 種の染色体観察を行った. 7 種はすべて  
 $2n = 16$  の染色体数で, いずれも 2 倍体レベルと  
考えられる. これらの種名 (中国名) と染色体構  
成は以下のとおりである.

*A. caricoides* Regel (石生韭),  $12m + 2sm + 2st$

*A. deserticum* M. Pop (天山韭),  $14m + 2sm$   
(+2B)

*A. globosum* M. Bieb. ex Redoute (長喙葱),  
 $14m + 2st$

*A. korolkowi* Regel (褐皮韭),  $12m + 4st$

*A. obliquum* L. (高葶韭),  $16m$

*A. oreoprasum* Schrenk (灘地韭),  $14m + 2sm$

*A. platyspathum* Schrenk (寛苞韭),  $12m + 2sm +$   
 $2st$

これら 7 種のうち, 天山山脈の固有種である *A.*  
*caricoides* と *A. deserticum* の染色体数と核型は  
本研究がはじめての報告である.

(<sup>a</sup>岡山大学教育学部生物学研究室,

<sup>b</sup>広島大学理学研究科附属

植物遺伝子保管実験施設,

<sup>c</sup>中国科学院植物研究所,

<sup>d</sup>昭和薬科大学生物化学研究室)